Readme (EEG3D) for ISIDE release 14.0.2

Electroencephalogram(EEG) simulation can be done by EEG3D.isml.
Simulation flow is shown in Fig. 1.

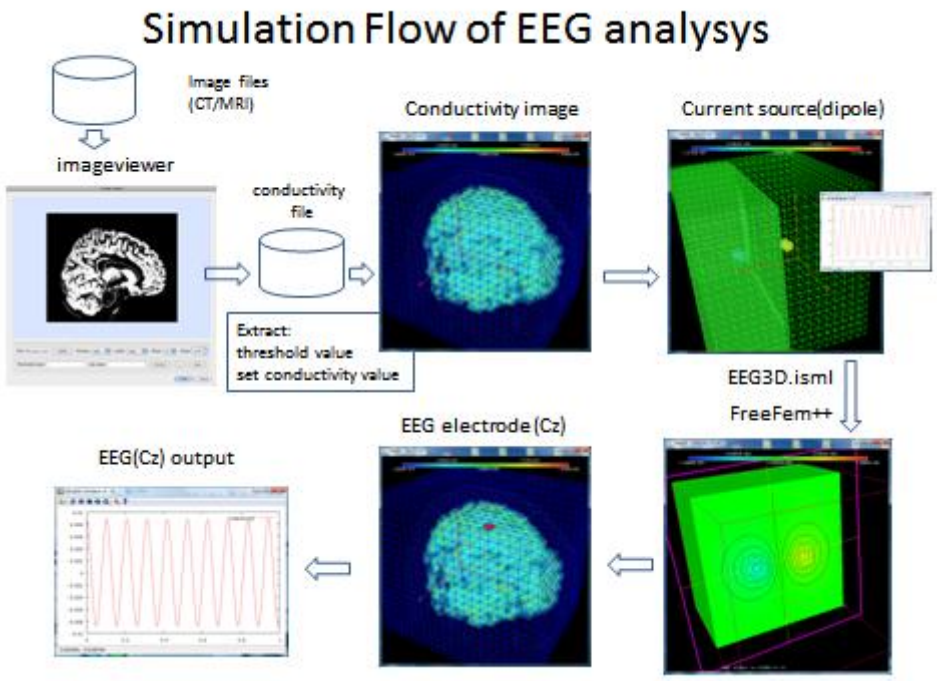

Fig. 1. Simulation flow of EEG analysis

From image files (for example, matlab image data), conductivity values of σ (x,y,z) are extracted. Simulation region is a cubic mesh structure in which brain is located. Obtained conductivity is assigned to each mesh point. Putting a current source dipole whose strength vibrates with a certain frequency at your hoped position, Poisson equation is solved to get electric potential. Observing time dependent potential at specific electrode, EEG signal is obtained.

isml model structure is shown in Fig. 2.
It has four functional modules and two capsule modules. Morphology module defines simulation structure, cuboid mesh, and electrical potential module solves Poisson equation and rest of two modules is capsuled to solve current source dipole's vibration motion. Two modules solve current (charge) strength and frequency alternatively. This vibration influences electric field in brain and EEG signal also.

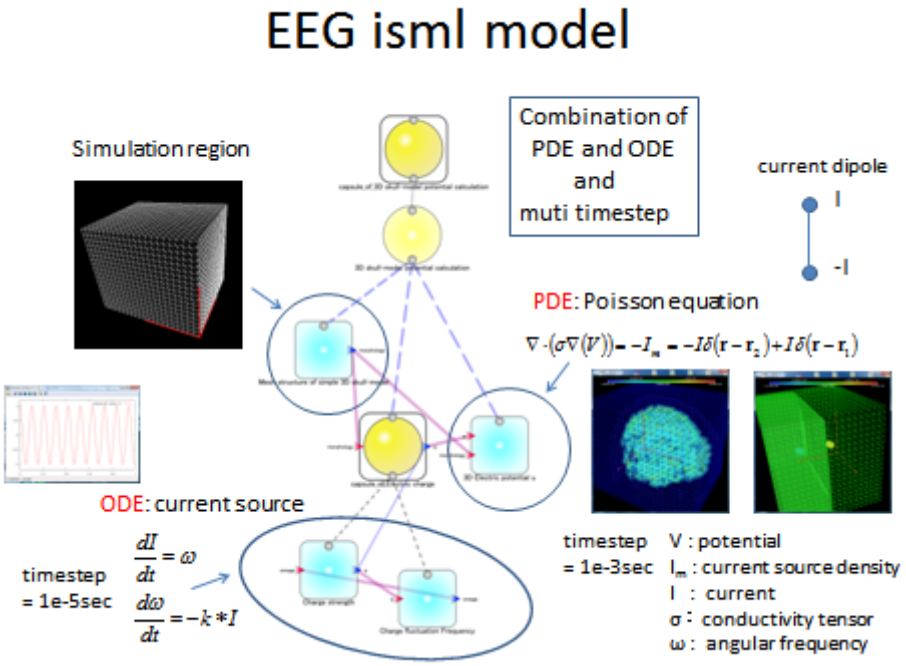

Fig. 2. EEG3D isml model structure

Conductivity values in the brain are included in a external file “sigma.txt” which is generated by image viewer of morphology editor in insilicoIDE. From CT images, filtering with threshold value, conductivity is set to selected region. Summing up each part’s (grey, white, csf, skullBone) conductivities, whole conductivity is stored in a single file.

Acknowledgement:
We thank Dr. Yamaguchi of RIKEN and prof. Mizuhara of Kyoto University for giving valuable advice and offering image data and sample MATLAB code.

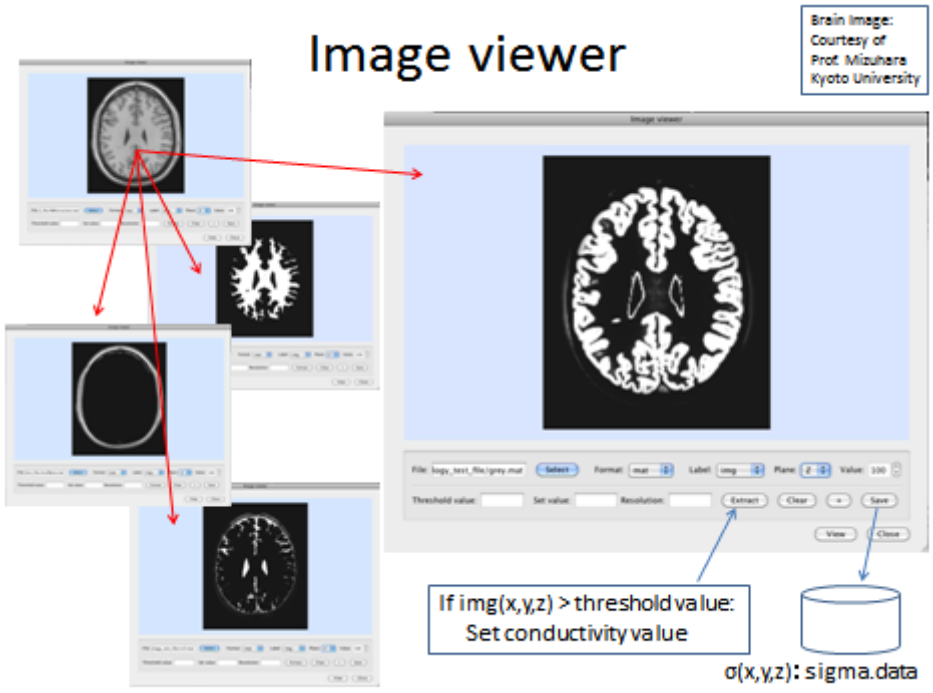

Fig. 3. Image viewer

Notice:

Put conductivity file sigma.txt in the same directory at which FreeFem++ script was exported. You will find sigma.txt in the sample directory of ¥insilicoPlatform¥insilicoIDE¥sample¥SimulateWithFreeFem.

Though, exported FreeFem++ code has a pre-installed plot command, it can't show inner behavior.

```
plot(u,fill=1,value=1,cmm="t = "+t,wait=false);
```

Instead of this plot command, if you revive following medit command, it will be better to observe inner potential distribution.

```
// medit ("plot",Th01,u);     (remove // )
```

It will generate medit windows per each timestep dt1. If it is too often, change timestep dt1 to dt3, for example 1.e-2.

For example, change as follows.

```
real dt0 = 1.e-5;
real dt1 = 1.e-3;
real dt3 = 1.e-2;
```

```
  if ((t-dt3*floor((t/+dt/2)/dt3)) < dt/2) {
    medit("plot",Th01,u);
  }
```

As for observing electrode, current install has no option to save this position's potential per each timestep.
For example. If you want to get Cz position's potential,

```
ofstream fout("u.txt");
for (real t=tinit; t<tmax; t+=dt) {
---------
  if ((t-dt1*floor((t+dt/2)/dt1)) < dt/2) {
      plot(u,fill=1,value=1,viso=viso(0:viso.n-1),cmm="t = "+t,wait=true);
      fout << t << "    " << u[][4159] << "    " << q << "    " << omega << endl;
  }
```

will save u value into "u.txt" file at each tmestep.

Then, if gnuplot is available,
gnuplot> plot "u.txt"
will show EEG signal at Cz position.

Thank you for your patience.
Improved post-processing option and electrode configuration option will be ready in near future's release.